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INTRODUCTION

According to a two-year survey, Africa probably contained in 1974 fewer than 25,000 cheetah, possibly as few as 10,000. More important, the total which was almost certainly twice as high in 1960, could well be reduced by half again by 1980.[1] The downward trend is more significant than the total number.

The principal problem lies with disruption of cheetah habitats and life-support systems, due to increasing antagonism of livestock owners toward wild predators and to settlement of savannah grasslands by cultivators who can no longer find sufficient room in Africa's limited zones of intensive agriculture. This trend toward increased antagonism and settlement reflects a number of economic relationships between the advanced world and emergent Africa. To this degree, the chief threat to the cheetah derives not from persons posing a direct and deliberate threat (poachers and fur trade operators), but from people whose activities induce unwitting pressures on the cheetah's welfare.

Past conservation initiatives, like the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora,[2] have brought direct relief to hundreds of threatened species

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[1] Myers, *The Cheetah Acinonyx jubatus in Africa,* Monograph No. 4, Int'l Union for Conservation of Nature and Nat. Resource (IUCN) Morges, Switzerland (1975).

[2] Among recent writings see *Toward Legal Rights For Animals,* 4 ENV. AFF. 205 (1975); *Endangered Species Protection: A History of Congressional Action,* 4 ENV. AFF. 255 (1975). Certain other writings are also relevant to this general area. While much has been written about the role of environmental conservation law within a national context, less attention has been directed at the more similar efforts of legal and related institutional initiatives to assist conservation at the international level. Also see Bleicher, *An Overview of International Envi-*

through intervention of the law.[3] However, such initiatives, which focus on direct and deliberate threats to animals, afford only marginal aid to the cheetah. Even if the international fur trade were to conform to the Washington Convention's requirements by terminating all dealings in cheetah skins, the main threat to the cheetah would remain.[4]

The cheetah needs assistance of more comprehensive scope than direct legal protection against a few harmful trade practices. It needs support that safeguards the species' life-support systems, as well as individual animals' lives. This postulates broadly-conceived economic and political initiatives as well as legal programs. Such initiatives, in the spirit of the Washington Convention, must reflect the role of communities outside Africa which contribute to the decline of African wildlife. Furthermore, the cheetah serves as an illustration of the pressures that increasingly afflict developing-world wildlife through loss of habitat and disruption of life-support systems. To that extent, the cheetah's plight illustrates emergent needs for a multitude of threatened species.

BIO-ECOLOGICAL BACKGROUND

Certain characteristics of the cheetah's ecology and ethology make it more vulnerable than most predators to threats within its

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ronmental Regulation, 2 ECOLOGY L.Q. 1 (1972); Contini & Sand, *Methods to Expedite Environment Protection: International Ecostandards,* 66 Am. J. Int'l L. 37 (1972); R. FALK, THIS ENDANGERED PLANET (1972); Falk, *Environmental Policy as a World Order Problem,* 12 NAT. RESOURCES J. 161 (1972); Frank, International Legal Mechanisms for the Protection of Endangered Species (paper presented at AAAS Meeting on Endangered Species, San Francisco (Feb. 27-28, 1974)); Grieves, *International Law and the Environmental Issue,* 1 ENV. AFF. 826 (1972); Hansen, *Creating New International Arrangements for Environmental Quality Control,* 3 NAT. RESOURCES LAW 739 (1970); LAW, INSTITUTIONS AND THE GLOBAL ENVIRONMENT (J. Hargrove ed. 1972); D. KAY & E. SKOLNIKOFF, WORLD ECO-CRISIS: INTERNATIONAL ORGANISATION IN RESPONSE (1972); MacDonald, *International Institutions for Environmental Management,* 26 INT'L ORGANISATION 372 (1972); McDougall, *Legal Bases for Securing the Integrity of the Earth-Space Environment,* ANNALS OF THE NEW YORK ACADEMY OF SCIENCE (1971); Robinson, International Obligations for National Protection of the Environment (paper presented at Meeting of Environmental Lawyers, Moscow (June 20-24, 1974); J. SAX, DEFENDING THE ENVIRONMENT (1970); and T. WILSON, JR., INTERNATIONAL ENVIRONMENTAL ACTION: A GLOBAL SURVEY (1971).

[3] ENVIR. L. REP. 1350 (1973).

[4] The Convention has not yet been ratified by France, Spain and Japan among major consumer countries and is in force in only one (South Africa) out of 20 countries in Africa with significant cheetah populations. *See* Bulletin of the Int'l Union for Conservation of Nature and Natural Resources (IUCN), Morges, Switzerland, New Series Vol. 7, nos. 8-9, 11 (Aug., Sept. and Dec. 1976).

wildland ecosystems, even before introduction of man's disruptive practices. Indeed the cheetah has never been numerous as compared with other cats in Africa. The lion inhabits many different wilderness zones and the leopard inhabits virtually all biotic provinces of Africa, but the cheetah's main habitats are confined to savannah grasslands.[5] To a visitor travelling across the Serengeti Plains and other well-known wildlife areas of northern Tanzania and southern Kenya, open grasslands appear to be characteristic landscapes of wilderness Africa. Yet these savannahs make up less than 10 percent of Africa south of the Sahara.[6] In fact 100 years ago, before extensive modification of Africa's wildland environments, there may not have been more than 100,000 cheetah, as compared with possibly 250,000 lions and a far larger number of leopards.[7]

Moreover, whereas the lion often maintains densities as high as one animal to five square miles, and the leopard higher densities still, the cheetah rarely achieves a density higher than one to twenty-five square miles, frequently only one to one hundred square miles.[8] These low densities for the cheetah are partly due to carnivore competition. While many predators are nocturnal and use a stealthy close-quarters attack, the cheetah hunts by extended chase during the day, a practice which makes its hunting activities conspicuous.[9] A cheetah with a newly-caught prey quickly attracts other carnivores which come to deprive it of its food. Being light in build and little able to defend its kill, the cheetah is frequently robbed of its prey by lions, leopards, and especially by spotted hyenas.[10] Moreover, the cheetah, a lone hunter, cannot overpower

[5] *See* Myers, *supra* note 1. For further details on the cheetah, see R. EATON, THE CHEETAH: THE BIOLOGY, ECOLOGY AND BEHAVIOR OF AN ENDANGERED SPECIES (1974); W. Labuschagne, Ecology and Ethology of the Cheetah in Kruger and Kalahari Gemsbok National Parks, South Africa (1975) (unpublished Ph.D. thesis, Univ. of Pretoria); R. McLaughin, Aspects of the Biology of Cheetahs, *Acinonyx Jubatus* (Schreber), In Nairobi National Park (1970) (unpublished M.Sc. thesis, Univ. of Nairobi); and N. WROGEMANN, CHEETAH UNDER THE SUN (1975). For details of the lion, leopard and other large predators, see Myers, *The Leopard Panthera Pardus in Africa*, Monograph No. 5, Int'l Union for Conservation of Nat. Resources (IUCN), Morges, Switzerland (1976); de V. Pienaar, *Predator-Prey Relations Among the Larger Mammals of the Kruger National Park*, 12 KOEDOE 108; G. SCHALLER, THE SERENGETI LION (1972).

[6] *See* Myers, *supra* note 1; Eaton, N. WROGEMANN and MYERS, *supra* note 5.

[7] These totals remained steady until the 1960's. *See* Myers, *supra* note 1; Myers, *supra* note 5.

[8] *See* Myers, *supra* note 1; EATON, Labuschagne, McLaughlin, and N. WROGEMANN, *supra* note 5.

[9] *Id.*

[10] *Id. See also* H. KRUUK, THE SPOTTED HYENA (1972); MYERS, *The Cheetah's Relationships*

large prey, and usually kills small or medium-sized animals. A cheetah does not store food, or scavenge, and must kill two or three times as often as a lion or a leopard.[11] If a fight in defense of a prey carcass leaves a cheetah with only a minor injury to a leg, the cheetah may be unable to sustain a chase when it pursues its next prey.

The cheetah's young are likewise vulnerable. They cannot climb trees like leopard cubs and they cannot rely on "baby sitting" safeguards such as lions sometimes employ.[12] Cheetah cubs must follow their mother on wide-ranging treks across open country, and become targets for mammal carnivores and birds of prey. They also seem unusually susceptible to disease. Although cheetahs reproduce at higher rates than do lions or leopards, the number of young cheetahs reaching adulthood often achieves no more than replacement.[13] While cheetah litters may total as many as five or six cubs with three or four reaching juvenile status, populations remain apparently stable at numerical levels far below those for most other large carnivores of Africa.[14]

To cite a specific instance, the Serengeti Park in northern Tanzania covers an area of 10,000 square miles, of which at least half is grassland or open woodland, with half a million gazelles. Yet in these seemingly favorable hunting conditions, the ecosystem's stock of cheetah remains at 200-250, or one to 40-50 square miles.[15] This density typifies cheetah populations in ecosystems elsewhere in savannah Africa. Part of the explanation for the low figure probably lies with disease, and part lies with Serengeti's 900 leopards, 2000 lions, and 3000 hyenas, which exert indirect competitive pressure and direct predatory pressure that keep the cheetah a relatively rare creature.[16]

The evolutionary strategy of low densities has presumably served

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to the Spotted Hyena, AMERICAN ASS'N OF MAMMALOLOGISTS, Proceedings of Predator Symposium, Univ. of Montana, June 16-18, 1975 (in press, 1977).

[11] *Id.*

[12] *Id.* For details of lions' "baby sitting" activities, see SCHALLER, *supra* note 5. Social systems among lions and especially among females, center on the pride, an assembly of mostly female adults. Sometimes, when a lioness with cubs needs to hunt, she leaves her cubs with other lionesses of the pride to safeguard the defenseless offspring against hyenas, leopards, jackals, eagles and other predators. The cheetah, by contrast, is a much more solitary animal, and a mother cheetah hardly ever finds she can leave her cubs with another adult while she goes off hunting.

[13] *See* Myers, *supra* note 1; EATON, N. WROGEMANN and Myers, *supra* note 5.

[14] Exceptions include the wild dog or African hunting dog. *Id.*

[15] *See* SCHALLER, *supra* note 5; KRUUK, *supra* note 10.

[16] *See* Myers, *supra* note 1.

the cheetah well because its populations have never been large and concentrated enough to supply a favorable resource for predators or for pathogens and parasites. Moreover, a wide, though patchy, distribution decreases the probability of a catastrophic event causing extinction for populations over the species' entire range at one time. As long as a particular stock always restored its numbers through immigration of additional cheetah from populations elsewhere, the species could survive. Fortunately, the cheetah shows more capacity to colonize sparsely occupied areas than does the lion, for example. Yet, ironically, this strategy now proves a massive liability for the cheetah. As its savannah habitats become modified through man's influence, its populations cannot maintain contact with each other so well as in the past. This proves a much greater threat for the cheetah than it would for the lion or the leopard, which exist at higher densities. Lions and leopards do not seem susceptible to so many "natural" threats, and need not rely upon immigration of additional populations.

Because of these characteristics, Africa's protected areas offer little sanctuary for cheetah. Although savannah parks and reserves cover at least 150,000 square miles, an area almost as large as California, cheetah are found in only about one third of them, where they total only 3000 individuals at most.[17] As park surroundings become developed, parks will become ecologically isolated from one another. This means that park populations of cheetah, many totalling only a few hundred individuals at most, will become cut off from one another. Each cheetah population will, thereby, become susceptible to a variety of natural catastrophes, including pandemic diseases, changes in prey community make-up, increased competition from other carnivores, alterations in vegetation configuration, and similar shifts in ecosystem dynamics. Cheetah are unusually sensitive to such catastrophes. Parks as ultimate sanctuaries, therefore, represent a high-risk strategy, for immigration between isolated parks to restore populations will become impossible. In any case, parks themselves are not certain to survive in the long term.[18] Similar constraints would apply to areas specially given over to protecting the cheetah, since the species is dependent more than most large predators on overall stability in its life-support systems, which

[17] *See* Myers, *supra* note 1.

[18] Myers, *National Parks in Savannah Africa,* 178 SCIENCE 1255 (1972); THE LONG AFRICAN DAY (1972).

implies natural environments with full diversity of associated species. Such diversity would be less likely to exist were preservation efforts to focus exclusively on the species itself.[19]

AFRICAN LAW AND WILDLIFE CONSERVATION

Review of the history and status of wildlife law in Africa focuses the cheetah's plight from a legal perspective. Remarkably, there has been quite a history of legal initiatives to safeguard African wildlife, not only by individual countries but by the continent as a unit.

In 1900, first steps were taken toward an international agreement for wildlife conservation throughout colonial Africa,[20] but the effort proved abortive. Simultaneously, most colonial governments took steps to regulate hunting of wild creatures within their holdings. In 1933, the London Convention Relative to The Preservation of Fauna and Flora in Their Natural State was drawn up.[21] This Convention, signed by all the main colonial powers, and Egypt, Sudan, and South Africa, was the first substantive treaty under international law aimed at safeguarding wildlife resources and natural environments in Africa. Not only were wild animals protected from the sporting rifle, but wild plants and vegetation were protected from the plough. Special attention was directed at East and Central Africa, the main areas containing great throngs of savannah game. This document proved a farsighted agreement, providing some security for wild creatures and for their habitats. The Convention covered hunting, parks and reserves, and trade in trophies. Contracting governments agreed to enact legislation to enforce the Convention's

[19] These circumstances also mean that the cheetah's eventual prospects could be worse than those for the Bengal tiger. The tiger now totals fewer than 2,000 left in the wild. *The Challenge of the Tiger: Saving an Endangered Species*, in WORLD WILDLIFE YEARBOOK 1973-74 (P. Jackson ed. 1975). Nevertheless, the tiger lends itself to a "sanctuary strategy" and can be adequately safeguarded through a string of parks and reserves which nations of the Indian subcontinent are establishing for its protection. *Id.* A 500-square mile piece of forest habitat can protect at least five and sometimes ten times as many tigers as a similar-sized piece of savannah achieves for the cheetah. Moreover, a remnant population of 100 tigers stands a better chance of surviving as a viable gene pool than 100 cheetahs because the tigers would not be susceptible to such severe "natural pressures" (*e.g.*, disease, competition from other carnivores) as would cheetah. If cheetah in Africa continue to decline at present rates for another 10 years, efforts to save the species in the wild could cost more per unit animal and per unit part of the species than efforts to save the tiger, with less assurance that the investment would pay off.

[20] For a detailed review see Ogundere, *The Development of International Environmental Law and Policy in Africa*, 12 NAT. RESOURCES J. 255 (1972); Burhenne, *The African Convention for the Conservation of Nature and Natural Resources*, 2 BIOLOGICAL CONSERVATION 105 (1970).

[21] *Id.*

provisions. The Convention, however, was ineffective. Few governments took the legislative steps required, and those that did rarely enforced their laws.[22]

By the early 1960's, as numerous African countries became independent, a new conservation initiative was needed. The need was two-fold: to provide a basis for national legislation and to coordinate conservation measures across frontiers. In 1963 the Commission for Technical Cooperation in Africa South of the Sahara, together with the Scientific Council for Africa, adopted an African Charter for Protection and Conservation of Nature, a document that enshrined modern ecological principles.[23] The Charter catalysed a process of intergovernmental consultations, leading to a 1965 request from the Organization of African Unity for the two main United Nations agencies involved[24] to draft, in conjunction with the International Union for Conservation of Nature and Natural Resources, a broad-scope document that would reflect modern needs. In 1968, 38 African governments signed a new treaty, The African Convention for Nature and Natural Resources.[25] However, not all states in Africa signed, and not all signatories ratified. Most significantly, only a few ratifiers did much to implement the Convention. The treaty did serve as a guide for those countries wishing to enact realistic legislation for conservation of their wildlife, vegetation, soil, water, and other natural resources.

In particular, the Convention drew up lists of wildlife species deserving special protection.[26] According to the Convention, class A species receive total protection in contracting states, whereby "the hunting, killing, capture or collection of specimens shall be permitted only on the authorization in each case of the highest competent authority and only if required in the national interest or for scientific purposes."[27] This list includes the cheetah.[28]

Almost all African countries now extend complete protection to the cheetah. The main exception is Namibia (S.W. Africa), which is nevertheless considering new legislation to give the cheetah in-

[22] *Id.*

[23] *Id.*

[24] Food and Agriculture Organization of the United Nations (FAO) and United Nations Educational, Scientific, and Cultural Organization (UNESCO).

[25] For full text of the Convention, see Burhenne, *supra* note 20.

[26] *See* Article VIII of the Convention.

[27] *See* note 25, *supra.*

[28] The cheetah is the only one listed of seven major widely-distributed carnivores in Africa.

creased if not total protection.[29] But in virtually all countries law enforcement agencies are meager, and with so many other law enforcement problems, wildlife in general, let alone threatened species, receives little attention.[30]

Basis of Conservation Strategy for the Cheetah

As indicated above, the cheetah's long-term survival in the wild depends largely on areas outside parks and reserves. These areas are now undergoing rapid development and disruption. Conservation strategy should therefore emphasize integration of the cheetah's needs with competitive human activities in large tracts of savannah Africa—a process that requires broadly-conceived conservation initiatives, in contrast to limited-focus measures such as parks and reserves.

This integration postulates an expanded approach to conservation in Africa. Parks and reserves seek only to establish islands of wilderness within a sea of development; legal efforts and practices in Africa have mainly aimed at safeguarding wildlife against hostile activities such as poaching. The broader problem is to coordinate the cheetah's needs with a spectrum of human demands in savannah territories. In other words, the challenge is to achieve a balance between safeguard measures for the cheetah and competitive human interests, rather than to defend the cheetah's needs as if cheetah values were absolutes in the equation. This form of conservation should not seek to protect wildlife in conflict with an "enemy" of human development activities, but in complementary accord with whatever other forms of land use lay claim to savannah resources. Since habitat loss is likely to become the principal threat to creatures not only in Africa but in other similar parts of the developing world, a solution for the cheetah could serve as a model for conservation plans that many species in many areas will require in the years ahead.

Economic Development as a Threat to the Cheetah

(a) Pressures within Africa

Despite its "natural" handicaps, the cheetah has maintained numbers and densities which have proved stable enough across

[29] Personal communication from officials of Department of Nature Conservation, Windhoek, Namibia (1976).

[30] *See* Myers, *supra* note 1.

broad tracts of Africa for centuries. But the past decade has witnessed a change. Pressures which eliminated the cheetah over the greater part of its range in Asia are fast gathering force in Africa.

Two different communities contribute to the creature's decline: stockmen and cultivators. Stockmen of all kinds, including commercial operators,[31] pastoralists attempting upgraded husbandry,[32] and nomadic stockmen struggling to survive,[33] are turning against the cheetah. These groups assert that cheetah are now taking increasing numbers of calves, sheep, and goats. While the allegations are often grossly exaggerated, cheetah doubtlessly stray among domestic herds more frequently than they did in the past due to intensifying land use pressures in the environs. At the same time, the cheetah's natural prey in these livestock areas diminishes through increased competition from domestic herds for range resources such as forage and water. In Kenya, Tanzania, Botswana, Rhodesia, and Namibia—all countries with major cheetah populations—livestock numbers have increased during the past twenty-five years at rates between 4 and 8 percent per year.[34] As its natural prey declines, the cheetah raids domestic stock. The stockman, in his attempt to make stock raising more efficient, now seeks to ensure profit from every animal in his holding, so he is less likely to remain ignorant of, or to ignore, occasional depredations by cheetah. Although other predators also maraud on domestic herds for similar reasons, the cheetah is by far the easiest for the stockman to kill, due to its open-range daytime hunting.

To cite some specific instances, the 2100-square mile Liebig's Ranch in Rhodesia increased its cattle holding between 1966 and 1972 from 35,000 to 55,000 head.[35] During the same period, its impala and other antelope stocks, traditional prey for the cheetah, decreased markedly, and cheetah attacks on calves and sheep increased eight times.[36] Another rancher in the same lowveld area lost only an occasional animal to cheetah during 20 years, until two calves were taken in 1969, six in 1970, eight in 1971 and over 20 in

[31] For example, ranchers in Kenya and southern Africa.

[32] For example, the Massai in East Africa and the Herero in Namibia.

[33] For example, the Tuareg and Peul in the Sahel zone of West Africa.

[34] *See* Myers, *supra* note 1. Tanzania had 6 million cattle in 1950, 10 million in 1966, and almost 15 million in 1975.

[35] *Id.* Rhodesia had 4 million cattle in 1967 and almost 5 million in 1975.

[36] *Id.* Figures are available only up to the time of the author's visit to the country in 1972, but stock losses are reputed to have continued to rise since then.

1972.[37] A large ranch in Namibia lost 43 calves, valued at $1400, to cheetah in 1971.[38] Another Namibia rancher, with strong conservationist convictions, began live-trapping cheetah on his property for release into parks and reserves; between 1954 and 1972 he caught 154 cheetah (and 186 leopards), yet he lost 68 calves and 102 sheep in 1972 (only a few to leopards).[39]

Stockmen are not the only threat to the cheetah. Increasing congestion now exists in the small-sized and over-loaded fertile zones that comprise less than 10 percent of Africa south of the Sahara, and cultivators are spreading into the next most favorable areas for human settlement, the savannah grasslands. Since these savannah zones are limited, they are at a premium for both human expansion and the cheetah's survival. In parts of Kenya, Ethiopia, Tanzania, Zambia, Sudan, and Cameroon, this migratory pattern causes human populations in savannahlands to expand at rates far above those due to natural increase.[40] Africa's rural population is expected to increase by 15 percent in 1976-1980.[41] A disproportionate part of this increase will take place in the savannah zones, and the cheetah's effective range could be cut by as much as 30 percent during this short period alone.

These two threats to the cheetah, from stock-owning communities and from cultivators, are now of much more consequence than poachers who cater to the international fur trade.

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[37] *Id.*

[38] *Id.* This loss by a Namibia rancher could have been more apparent than would have been the case in former years, since the rancher was keeping more accurate records of his herds. But his assertion that cheetah had grown more numerous could be true as he had carried out intensive trapping campaigns against hyenas and jackals, both of which prey on cheetah cubs.

[39] *Id.*

[40] I-II POPULATION IN AFRICA DEVELOPMENT (P. Cantrelle ed. 1975); J. CONDE, THE DEMOGRAPHIC TRANSITION AS APPLIED TO TROPICAL AFRICA (1971); J. CONDE, SOME DEMOGRAPHIC ASPECTS OF HUMAN RESOURCES IN AFRICA (1973); ECONOMIC COMMISSION FOR AFRICA, REPORT OF THE AFRICAN POPULATION CONFERENCE, Accra, Ghana, Dec. 9-18, 1971 (1972); ECONOMIC COMMISSION FOR AFRICA, APPLICATION OF DEMOGRAPHIC DATA TO DEVELOPMENT PLANNING, AFRICAN POPULATION STUDIES No. 1 (1974); W. HANCE, POPULATION, MIGRATION AND URBANIZATION IN AFRICA (1970); Myers, *supra* note 18; Myers, *The People Crunch Comes to East Africa*, NAT. HIST. (Jan. 1973); S. OMINDE & C. EJIOGU, POPULATION GROWTH AND ECONOMIC DEVELOPMENT IN AFRICA (1972); N. VAN RENSBURG, POPULATION EXPLOSION IN SOUTHERN AFRICA (1972); Wisner & Mbithi, Drought in Eastern Kenya (paper presented at 22 Int'l Geog. Congress, Commission on Man and Environment, Calgary, Alberta, Canada (July 24-30, 1972) (these latter two writers cited rates of population increase in savannah-lands of eastern Kenya as high as 10-35 percent per year).

[41] *See* CONDE AND ECONOMIC COMMISSION FOR AFRICA, *supra* note 40; *see also* C. OXBY, PASTORAL NOMADS AND DEVELOPMENT (1975)

(b) Pressures from Outside Africa

Pressures from human communities stem not only directly from increasing African populations with growing aspirations, but also derive indirectly from the developed world's desire for more goods of the kind which induce land use changes in African savannahs. For example, livestock owners in Africa now seek to respond to the world's beef shortage. Worldwide demand for meat is projected to rise by 3.1 percent per year between 1970 and 1990, with demand for beef increasing by 4 percent per year.[42] This rate of increase is higher than the rate of increase in demand for other foods except fish. The demand for beef causes stockmen to occupy rangelands formerly little used. In Kenya, for example, 80,000 square miles or one third of the country will be subject to varying levels of intensive livestock production, an area five times greater than commercial enterprises have hitherto occupied.[43] At the same time, stockmen receive increasingly narrow profit margins, induced in part by international market constraints. These twin factors—increased extensiveness and intensiveness of livestock operations—leave stockmen less ready to share the range with wild creatures.

To cite a specific instance, Botswana dispatches 80 percent of its beef output abroad, including 30,000 tons a year to Europe.[44] When a European housewife goes to her local supermarket to buy beef that comes from Botswana, she wants it at a "reasonable" price, a price competitive with beef from other sources that may not feature wild predators as a major cause of stock losses. She thereby encourages unwittingly, and without malice toward the cheetah, the cattle raiser in Botswana to eliminate cheetah on his rangeland holding. Botswana contains 1500-2500 cheetah, probably the second largest total in Africa after Namibia, and the total is declining more rapidly through stock-raisers' depredations than through any other single cause.[45]

Similar pressures induced by advanced-world living styles cause African cultivators to migrate into savannah grasslands. The flood of landless people heading for cheetah habitats could be stemmed

[42] FAO, State of Food and Agriculture 1975 (1976).

[43] AGRICULTURAL DEVELOPMENT IN KENYA: AN ECONOMIC ASSESSMENT (J. Heyer, J. Maitha & W. Sengaeds 1976); REPUBLIC OF KENYA, I-II DEVELOPMENT PLAN 1974-78 (1974).

[44] *See* Rake, *Botswana Economic Survey.* AFRICAN DEV. 93-102 (Jan. 1976); Rake, *Botswana Economic Survey,* AFRICAN DEV. 888-916 (Sept. 1976).

[45] *See* Myers, *supra* note 1.

somewhat through more favorable trade terms in international markets. For example, a Kenya farmer must now sell three times as much coffee to buy a foreign-made piece of machinery, *e.g.* a light tractor, as in 1960.[46] He can earn a tolerable cash income from two acres of coffee in the more productive parts of Kenya, but he must cultivate six to eight acres of maize in savannah areas to ensure the same income. Insofar as he usually receives little more in real terms for his coffee than in 1960, he sees diminishing cause to stick with the cash crop; by consequence, he is increasingly inclined to abandon attempts to make a living off a small patch of high-productivity land and to join the throngs headed for the savannah grasslands. Moreover, the greatest share of the profit from powder coffee accrues after the raw beans have left Africa.[47] If processing of beans were permitted before export, the crop could be made much more profitable for Africa's coffee growers. But the multinational corporations that dominate the coffee trade generally refuse to purchase coffee in any form other than raw beans, so that they can retain the high-profit processing. In this sense, the cheetah's life-support systems extend to the American breakfast table, where coffee is the commodity which has shown least price increase (the present temporary peak apart) during the past 20 years.[48] Much the same applies to consumers in advanced nations when they purchase other goods

[46] The present price bonanza for coffee is not likely to persist any more than the (smaller) surge in prices in 1972-73. These short-term phenomena make little difference to the long-term trend for coffee prices. *See* INTERNATIONAL COFFEE ORGANIZATION, MONTHLY BULLETIN (April, Dec. 1976, Jan., April 1977). KENYA COFFEE BOARD, MONTHLY BULLETIN (Aug., Nov. 1976, Jan., March 1977). *See also* THE HASLEMERE GROUP, COFFEE: A STUDY OF THE INTERNATIONAL COFFEE TRADE AND THE INTERNATIONAL COFFEE AGREEMENT (1974); Raphael, *Boost for Africa's Coffee*, AFRICAN DEV. 35 (1975); Raphael, *Commodity Agreement Prospects; Coffee*, AFRICAN DEV. 487 (May 1976); P. STREETEN & D. ELSON, DIVERSIFICATION AND DEVELOPMENT: THE CASE OF COFFEE (1971); WORLD DEVELOPMENT MOVEMENT, THE WORLD IN YOUR COFFEE CUP (1976). It is true that the wholesale price of green coffee has increased from 72 cents per pound in 1974-75 to 142 cents in early 1977 and seems likely to climb still higher during 1977. This is due, however, to a severe frost in 1975 in Brazil, the world's largest producer, which cut output by almost three-quarters; to a "rust" blight on coffee trees in Nicaragua; and to civil disorders in Angola and Uganda—all of which factors have greatly reduced the amount of coffee available for world markets. None of these factors seems likely to persist as a permanent phenomenon and the most significant of them, the Brazil frost disaster, is already being left behind as new plantings replace those lost. By 1978 coffee prices should be declining and, if total productivity is restored, 1979 prices could be little different from 1975 prices (after allowing for inflation).

[47] *Id.*

[48] *Id.*

from developing Africa, such as tea,[49] cotton goods,[50] and sisal,[51] which are subject to the same marketing systems as coffee.

The cheetah's survival is thus determined not only by direct changes in physiobiotic environment of its wildland habitats. It is influenced by the socioeconomic environment of emergent Africa which is shaped by life styles in the developed world. These ecological-economic linkages among the international community are little recognized to date, but they represent a significant factor for land use patterns in Africa's savannahs. Africa, primarily an agricultural region, will either develop extensive agriculture that is wasteful of land, or intensive, efficient agriculture, the choice dependent in part on Africa's trading relationships with the developed world. These trading relationships thus have deep significance for Africa's wildlife.

Insofar, then, as people of advanced countries bear a responsibility for the cheetah's plight, they should be required to pay part of the price of ensuring the cheetah a future. Institutional initiatives to this end will be considered later in this paper.

(c) Spillover Aspects of the Situation

Pressures, from inside and from outside Africa, constitute "spillover effects" of people's activities as they impinge on the cheetah's existence. Spillover effects arise when the activities of a person or a group of persons produce unintended side-effects on other persons or groups.[52] Generally speaking, no compensatory adjustment of the external relationship is automatically available. Since these spillover effects lie at the heart of the cheetah problem, measures

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[49] *See* Raphael, *Tea: Problems Between Producers*, AFRICAN DEV. 489 (May 1976). *See also*, with regard generally to commodities and primary products from Africa, Rake, *Africa's Commodities*, AFRICAN DEV. 18 (Sept. 1975); RAKE, *UNCTAD-Kenya*, 1976 AFRICAN DEV. 476 (May 1976); Rake, *Commodities Start Uphill Climb*, AFRICAN DEV. 563 (June 1976).

[50] *See* Rake, *Kenya Textiles: Problems*, AFRICA DEV. 201 (March 1976) and P. KENYON, TEXTILES — A PROTECTION RACKET (1972). *See also* Rake, *supra* note 49.

[51] *See* Rake, *supra* note 49. *See also* Secretariat of United Nations Conference on Trade and Aid, Marketing and Distribution Systems for Commodites of Export Interest to Developing Countries, SUPPORTING PAPER TD/184/supp. 4, Conference Document for UNCTAD IV, Nairobi, Kenya, May 1976, prepared by UNCTAD Secretariat, Geneva, Switzerland (1976).

[52] For elaboration of the pervasive phenomenon of externalities in environmental conservation, see Ayres & Kneese, *Production, Consumption and Externalities*, 59 AM. ECON. REV. 282 (1969); Burrows, *External Costs and the Visible Arm of the Law*, 22 OXFORD ECON. PAPERS (NEW SERIES) 39 (1970); Mishan, *The Spillover Enemy: The Coming Struggle for Amenity Rights*, 33 ENCOUNTER (1969); E. MISHKIN, TECHNOLOGY AND GROWTH: THE PRICE WE PAY. (1970); *Coase Theorem Symposium* 13-14 NAT. RESOURCES J. 557 (1973-74).

for the cheetah's protection need to account for them.

To the extent that the problem of declining wildlife in Africa now constitutes a pervasive spillover effect of man's activities, threatened species may not be saved merely by finding malefactors bent on the species' destruction. Rather, economic forces which indirectly destroy the species should be recognized as the principal culprit. This conclusion is a departure from the 1960's way of looking at the position, when the good guys (conservationists) could run down the bad guys (poachers). Now there is generally only one category of participant: consumer. Some people in Africa consume land, other people outside Africa consume products of that land. Even the conservationist's perspective—insofar as he is a consumer—may accord with that of other citizens who pursue their legitimate self-interest without regard for the manifold unintended consequences of their actions.

Need for New Conservation Measures

In these circumstances, simple protection measures such as safeguarding relict numbers of a threatened species,[53] or preserving a crucial sector of a species' habitat,[54] may soon prove far from sufficient for many threatened species' needs. That approach is akin to trying to seclude wildlife altogether from an ostensibly hostile world of economic development. Emergent Africa is becoming too crowded for a "last-ditch sanctuary" strategy of that sort. In any case, so many species may soon be threatened that even an appreciable increase of conservation resources could prove incapable of limiting development. Increased resources will not remedy the problem as long as localized, fragmentary conservation programs treat symptoms rather than causes of destructive processes. Conservationists must seek ways to enable threatened wildlife to survive as extensively as possible in wildland habitats, in harmony instead of in conflict with economic activities. For this reason, the cheetah, with its low densities and wide-ranging needs, may serve as an experimental model with relevance to the general problem of threatened wildlife in Africa.

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[53] For example, remnant groups of the white rhinoceros have been gathered together so that they may be afforded special protection in several parks and reserves in South Africa and elsewhere.

[54] For example, the mountain gorilla is safeguarded by setting aside a number of localities in its main range along the Uganda-Rwanda-Zaire borders, to make up four parks and reserves established with the prime purpose of protecting the gorilla.

Far from intending harm to the cheetah through spillover pressures, many people in the advanced world show great interest in African wildlife. They presumably prefer that the cheetah continue to exist in adequate numbers. If they could exercise a choice, they might be willing to pay to ensure the cheetah's survival through the marketplace. Perhaps the time has come when people should pay to enjoy the "goods and services" which the cheetah represents, and pay through some substitute marketplace.

Benefits Derived from the Cheetah's Existence

People receive "benefits" from the cheetah's existence. These benefits arise mainly in the form of various satisfactions at the knowledge that the creature still survives in Africa. Significant as these benefits may be, people receive them free, because the cheetah's existence is not traded in the marketplace in competition with other goods and services among which consumers choose. So it costs nothing for wildlife supporters outside Africa to enjoy the satisfactions which the cheetah provides. But, just as people have not had to pay for the cheetah's survival, they now have little opportunity to pay to prevent its demise. In economic terms, they cannot express their preference through marketplace mechanisms for registering evaluation of the goods and services in question.[55] As Kahn expressed this general constraint with reference to other goods and services, the consumer is "victimised by the narrowness of the context within which he exercises his sovereignty."[56]

Yet there is little doubt that the satisfaction which many people

[55] When wildlife is evaluated in market terms, its "worth" may be compared with other goods and services with which it comes into conflict, and the various trade-offs involved in conserving wildlife may be more rationally appraised. Putting a price tag on wilderness "goods and services" in North America has been mainly confined to evaluatory analysis of recreation experience, whether with regard to wilderness environments such as Yosemite Park or wildlife-related activities such as hunting and fishing. This is only partially applicable to the problems posed by African wildlife as a whole, let alone one particular species such as the cheetah. But the methodology proposed could be of some relevance to resource economics analysis in Africa. *See,* for example, N. Coomber & A. Biswas, Evaluation of Environmental Intangibles (1973); C. Cicchetti, J. Seneca & P. Davidson, The Demand and Supply of Outdoor Recreation (1969); Natural Environments: Studies in Theoretical and Applied Analysis (J. Krutilla ed. 1972); Pearse, *A New Approach to The Evaluation of Non-Priced Recreational Resources,* 44 Land Econ. 87 (1968). A preliminary attempt to evaluate the loss to society consequent upon the extinction of a species is available in Bachmura, *The Economics of Vanishing Species,* 11 Nat. Resources J. 674 (1971).

[56] Kahn, *The Tyranny of Small Decisions: Market Failures, Imperfections, and the Limits of Economics,* 19 Kyklos 24 (1966).

receive from the cheetah's existence is substantial. As a crude minimal measure of this satisfaction, a 1972 television program in North America indicated much interest in the cheetah. Thirty-three million people watched the program at prime time.[57] These viewers expressed their interest in the cheetah by giving up a substantial amount of a highly valuable commodity, leisure time. This commodity is sufficiently intertradeable with other goods and services to allow evaluation of it almost as a currency.[58] Various approximations of leisure time's "worth" have been proposed, with one dollar an hour often accepted as a minimum working figure (1973 value). This means that 33 million people watching a half-hour program could be said to display a minimal evaluation of the cheetah totalling $16.5 million. One could suppose that similar evaluations have been displayed, and benefits received, when the television film was shown in Europe.

Additional interest has been shown through the sales of Joy Adamson's two books on her tame cheetah.[59] Including foreign translations, sales exceed two million copies.[60] If each copy, generally paperback, costs an average of $1.50, and reading time takes two hours, this represents a proxy evaluation of $7 million. Of course people derive pleasure from reading the book beyond satisfaction at the cheetah's existence, since they enjoy relaxation which is not exclusively determined by their interest in the cheetah. The same is true of television viewing, but a minimal evaluation evinced by this readership and television audience could be set, albeit in very crude and preliminary terms, at something over $20 million.

Of course this does not mean—and this critical reservation is

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[57] Figures from A.C. Nielson Company, New York, personal communication (1974). For figures on television viewing in Europe, see BRITISH BROADCASTING CORPORATION, WILDLIFE PROGRAMMES ON TELEVISION, AUDIENCE RESEARCH REPORT (1974).

[58] *See* Becker, *A Theory of the Allocation of Time*, 75 ECON. J. 493 (1965); Dickens, *How to Use Time*, NEW SOCIETY 566 (Sept. 1973); A. Evans, A General Theory of the Allocation of Time, (unpublished manuscript, Dep't of Economics) Univ. of Glasgow (1969); I. Harrison & E. Quarmby, *The Value of Time*, in COST-BENEFIT ANALYSIS 173 (R. Layard ed. 1972); Johnson, *Travel Time and Price of Leisure*, 4 W. ECON. J. 135 (1966); S. LINDER, THE HARRIED LEISURE CLASS (1970); Time Research Note No. 16 (Papers and Proceedings of a Conference on Research into the Value of Time, Department of the Environment, London, N. Mansfield ed. 1971); *Symposium: Time in Economic Life*, 87 Q.J. ECON. 627 (1973); and Watson & Mansfield, *The Valuation of Time in Cost-Benefit Studies*, in COST BENEFIT AND COST EFFECTIVENESS 222 (J. Wolfe ed. 1973).

[59] J. ADAMSON, THE SPOTTED SPHINX (1969); J. ADAMSON, PIPPA'S CHALLENGE (1971).

[60] Figures from publishers of two books in question, *id.*, in North America and Europe, personal communications (1976).

stressed—that people would thereby be prepared to put up sums anywhere near this amount in order to assist the cheetah's survival. Readiness to watch a television program or read a book need not translate into willingness to donate funds to keep the cheetah alive.[61] Whether people in affluent nations would be prepared to go along with conservation proposals that entail outlays of sufficient funds for the cheetah, is another matter altogether. The analysis here, of the cheetah's worth in dollar figures, is presented merely as an attempt to show that a reckoning of people's evaluation of their interest in the cheetah—a partial reckoning, calculated in minimal terms—results in a sum way beyond the costs that would be entailed in establishing effective conservation measures on the ground in Africa.

THE CHEETAH AS A COMMON HERITAGE AND COMMON PROPERTY RESOURCE

As indicated above, the cheetah affords satisfaction to society at large. Society will presumably continue to receive satisfaction from the cheetah in the future if the creature is still in existence. To this degree, the cheetah constitutes part of the common heritage.

Implicit in the first part of this article is the premise that the cheetah is worth saving. Although this has been assumed, more explicit evaluation may be appropriate. The fact that the cheetah is a charismatic creature as compared with a snake should help in generating public support for conservation programs. Yet this charisma is not the only outstanding characteristic of the cheetah. The species plays an important role in regulating savannah ecosystems. By virtue of its susceptibility to "natural" threats, the cheetah perhaps serves as an "indicator species" that gives early warning of environmental stress. This attribute, however, is not likely to carry any more weight with African stockmen than moves to bring back the wolf would appeal to American ranchers. Other characteristics are worth consideration. The cheetah could conceivably present benefits with respect to human health. The animal can accelerate from a standing start to 40 miles per hour in a couple of strides, and

[61] See text at notes 68-92, *infra* for an outline of some potential ways to translate putative "public interest" into specific conservation measures with some indication of order-of-magnitude costs. These costs prove to be well below the minimal evaluation of the cheetah's "worth" as postulated in this article, put (as a preliminary calculation) at something over $20 million.

then maintain a 60-mile per hour chase for several hundred yards. A creature which can tolerate a sudden and severe oxygen debt of that order may present clues for treatment of blood pressure and heart diseases in humans. Such pragmatic considerations, however, should not constitute the main argument for saving the cheetah. The principal reason for saving the cheetah is that it is there, nothing else is like it, and its disappearance could not be reversed by human ingenuity. Future generations should not be deprived of the satisfactions offered by the cheetah.

The cheetah, then, constitutes a "common heritage resource" of unique value. As such it deserves exceptional measures for its protection. At the same time, however, the cheetah tends to be treated, for reasons of institutional deficiency, as a "common property resource," subject to exceptional degrees of destruction.[62]

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[62] The term "common property" is sometimes and inaccurately thought to refer to resources for which no specific persons or groups can be identified as exercising private ownership. This is not correct. Strictly speaking, "common property" refers only to those resources for which institutional measures have been established to express the community's interest in terms approximating property rights. That is to say, they have been designated as property of the community in general, *res communis*, rather than property of nobody in particular, *res nullius*. *See* Angelo, *The Need for Strengthening Legal Systems for Protection of the Environment, in* THE ENVIRONMENTAL FUTURE 613 (N. Polunin ed. 1972); D. JOHNSTON, THE INTERNATIONAL LAW OF FISHERIES (1965). Institutional measures of this sort usually facilitate a regulatory system that conserves and allocates resources. *See* S. CIRIACY-WANTRUP, RESOURCE CONSERVATION: ECONOMICS AND POLICIES (3d ed. 1968)); *The Economics of Environmental Policy*, 47 LAND ECON. 36 (1971); Ciriacy-Wantrup & Bishop, *"Common Property" as a Concept in Natural Resources Policy*, 15 NAT. RESOURCES J. 713 (1975). But resource economists frequently use the term "common property" to refer to resources for which would-be exploiters enjoy "open access." This means the resource is available for anyone to come and harvest as he wishes (*e.g.* the man who hunts wild creatures for their products), or to dispose of as he thinks fit when the resource exists in competition with his exploitation of associated resources (*e.g.* the man who cultivates wildlife habitats). For purposes of this paper, the term is used in its latter, albeit loose, sense. For analysis of the complex field of common property resources in relation to environmental values, see *Environmental Economics*, 73 SWEDISH J. ECON. (1971); ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT, PROBLEMS OF ENVIRONMENTAL ECONOMICS (1971), POLITICAL ECONOMY OF ENVIRONMENT (1972) and PROBLEMS IN TRANSFRONTIER POLLUTION (1974); P. BARKLEY & D. SECKLER, ECONOMIC GROWTH AND ENVIRONMENTAL DECAY: THE SOLUTION BECOMES A PROBLEM (1972); Bishop, *Conceptual Economic Issues in Conserving the California Condor, in* WESTERN AGRICULTURAL ECONOMIC ASSOCIATION PROCEEDINGS 119 (1972); S. CIRIACY-WANTRUP, A. FREEMAN, R. HAVEMAN & A. KNEESE, THE ECONOMICS OF ENVIRONMENTAL POLICY (1973); Haveman, *Efficiency and Equity in Natural Resource and Environmental Policy*, 55 AM. J. AGRICULTURAL ECON. 868 (1973); MANAGING THE ENVIRONMENT: INTERNATIONAL COOPERATION FOR POLLUTION CONTROL (A. Kneese, S. Rolfe & J. Harned eds. 1972); J. KRUTILLA & A. FISHER, THE ECONOMICS OF NATURAL ENVIRONMENTS (1975); Myers, *Wildlife of Savannahs and Grasslands—A Common Heritage of the Global Community, in* EARTHCARE CONFERENCE, SIERRA CLUB NATIONAL AUDUBON SOCIETY WILDERNESS CONFERENCE PROCEEDINGS (in press, 1977); *The Human Environment*, 12 NAT. RESOURCES J. 134 (1972); *Changing Natural Resource Property Rights: An Overview*, 15 NAT. RESOURCES J. 639 (1975). For a consideration

The core of the common property problem is that the cheetah belongs to everybody in general, but to nobody in particular. No property or ownership rights are vested in clearly identifiable persons or groups. The cheetah's property rights are, in some sense, vested in the rancher on whose land an individual animal may be committing depredations. In other senses, the property rights appertain to the country within which the ranch is situated. At the same time, the cheetah "belongs" to the whole of Africa, as part of the continent's natural heritage. Moreover, the cheetah can be considered a legitimate interest of the world community, as part of mankind's patrimony. To achieve an acceptable distribution of these rights and responsibilities of ownership and interest is a complex challenge, due to conflicting ideas of exclusive jurisdiction such as ranchland ownership and national sovereignty. Insofar as various groups have an interest in the species, responsibility for safeguarding it should somehow be allocated between these groups.

The cheetah's status as common property contrasts with the status of private property with which the cheetah often comes into conflict. When an individual in Africa owns a cow, he enjoys readily recognizable property rights which enable and encourage him to take care of the animal and dissuade other people from using or misusing it. No one exercises property rights of this sort in the cheetah, so no one is endowed with the protection opportunities and responsibilities which are entailed in private property rights. No one is in a position to implement sufficient measures for the cheetah's survival. Wildlife agencies in Africa do what they can, but they are not able to offer the cheetah the degree of protection which a stockowner can exercise over his cattle. They find themselves trying to safeguard the cheetah within an institutional environment which tilts the balance against the cheetah and its wildland environment. In other words, African wildlife agencies are severely constrained by institutional systems—notably marketplace mechanisms—which favor private property (domestic stock) over common property (the cheetah).

An African country can exercise ownership in the cheetah within its territory through legal authority. But enforcement of the law across large tracts of savannah for a species with such broad and sparse distribution is difficult. The stockman who disposes of chee-

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of property rights see Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347 (1967); PERSPECTIVES OF PROPERTY (G. Wunderlich & W. Gibson, Jr. eds. 1972).

tah to prevent loss to his commercial or subsistence activities expects to escape prosecution because he knows that law enforcement is not widespread enough to protect the cheetah over extensive areas. The cultivator who digs up the cheetah's habitat cannot readily be charged with any offence at all, whether legal or moral, if he is digging in open access territory outside a park. Like the rancher, he is looking after his legitimate interest of self-support, in conflict with the interests of society at large. But whereas the rancher deliberately points a gun at a cheetah, the cultivator is almost certainly unaware that his digging hoe is also an effective tool for destruction of wildlife. In fact, a hoe is even more effective than a gun, insofar as elimination of habitat for a population of cheetah is more final than destroying a single or several individuals.

In sum, legal systems in emergent nations have generally been developed with the goal of promoting the rights of private property. They give far less attention to the needs of common property—a more complex concept that has only recently started to attract increased attention in advanced societies. Even the United States, with a sophisticated legal system and advanced law enforcement capacities, has been far from effective in safeguarding common property in conflict with private property.[63]

If legal systems of developing Africa tend to favor private as opposed to common property, the same is even more true of economic systems. As indicated earlier, stock owners now experience growing depredations of their herds by cheetah among other wild predators. Stockmen who kill marauding cheetah create greater public costs than private benefits. But, as is usual when individuals destroy common property resources, the rewards accrue to a small concentrated group of people, allowing each person of the group to derive appreciable benefit. By contrast, the losses being communal are spread among society, causing each individual's perceived loss to be small. Because the focus of the stockman's attention is his perceived legitimate self-interest, the spin-off consequences of his action may scarcely register with the stockman, even though he breaches the long-standing legal principle *"Sic utere tuo ut alienum non laudas"*—use your own property in such a way as not to harm someone

[63] As witness the failure of the law to eliminate illegal shooting of whooping cranes and bald eagles. This situation has improved in recent years, but not to the extent where legal fiat can prevent further wanton destruction of individual birds. Graham, *Will the Bald Eagle Survive to 2076?* 78 AUDBUON 99 (1976).

else's. This is of course the tragic dilemma of many a "commons" situation.[64]

To reiterate a basic premise, no market exists for the "goods and services" which the cheetah's survival makes available to society, thus no one trades in the cheetah's continued existence. If such trading opportunity existed, customers could demonstrate by their dollar votes how far they opt for the cheetah's survival in preference to other goods and services such as cheap food or a new set of clothes.[65] The lack of opportunity for the consumer to indicate a preference means the cheetah's worth cannot be priced in the way most goods and services are. Conversely, competitive activities in the cheetah's savannah habitats are sensitively evaluated in the marketplace. Markets pay profits for these competitive activities when they produce beef, whereas next to nothing is paid for the benefits of the cheetah's existence.

Those persons concerned about the cheetah cannot readily find opportunity to express their concern. Although a common property resource is of benefit to the community at large, it is exceptionally difficult to safeguard through private action. If public spirited individuals in North America and Europe were inspired by the cheetah's plight to make exceptional efforts to preserve it, their individual efforts would almost certainly prove inadequate. Especially in terms of the marketplace, their impact would be limited indeed. The market system, insofar as it caters at all to the cheetah's goods and services (for example, through wildlife-watching tourism), reflects only the amount that people are willing and able to pay. This "effective demand" is, in the cheetah's case, way below what people presumably would pay for the cheetah's survival if they had the chance and the assurance that everybody would pay his share.[66]

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[64] Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

[65] Americans and others can demonstrate some preference by going on a wildlife-viewing safari in Africa. But this does little to help the cheetah's cause. For one thing, tourists go to see lions, elephants and flamingos, as well as cheetah, and it is uncertain how much their enjoyment on safari would be reduced if they were deprived of the chance to see cheetah. More importantly, while it is true that tourists spend their money on parks and reserves which may thereby survive better (though even this is in doubt, *see* Myers, *The Tourist as an Agent for Development and Wildlife Conservation: The Case of Kenya*, 2 INT'L J. SOC. ECON. 26 (1975)), cheetah conservation must direct its efforts at savannahlands outside protected areas if the species is to survive in adequate numbers—and these savannah territories derive little benefit from the tourist dollars.

[66] The free-rider dilemma confronts the would-be protector of the cheetah who cannot be sure that he will achieve his objective by contributing from his cash, time, and other resources. He may even hope to attain the same end through what other people contribute. If

In common with individual beneficiaries of other common property resources, cheetah supporters have limited scope to organize themselves to express their preference with concentrated clout. Their effect is extremely diffused, hence lacking economic impact. At present cheetah supporters have no opportunity, for example, to pay the stockman to refrain from dispatching all the cheetah he sets eyes on. Registering effective demand for the cheetah depends not only on expressing commitment through cash disbursements. It depends on collective action, which means that responsibility rests with collective authority, *i.e.*, governments and intergovernmental organizations.[67] Collective initiatives to safeguard the collective resources represented by the cheetah will almost certainly require funds from the collective purse.

Conservation Strategies for the Cheetah

(a) Resolving the Conflict with Livestock Interests

The response by stockmen to wild predators in rangeland Africa tends to be undiscriminating in the extreme. This is evidenced by broad-scale use of poison, which may not hit the relevant species at fault let alone the individual marauder. In parts of Kenya, Tanzania, Zambia, Namibia, Rhodesia, and particularly South Africa, predator control in livestock areas has degenerated into a campaign for prophylactic extirpation of predators in general.[68] At the same time, would-be protectors of wildlife should recognize that the livestock industry in Africa must remain a valid and vibrant sector of emergent Africa's economy. The stockman in Africa has legitimate interests to protect, just as does the advanced-world citizen who is bent on preserving the cheetah. The livestock owner is not like the fur dealer who exploits the cheetah with the sole aim of private profit; he merely wishes to ensure he does not "come out behind."

Various possibilities exist to resolve the conflict of predators and livestock. These possibilities have not hitherto been investigated in any part of Africa due to gross lack of research funds.[69] One ap-

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a significant number of participants attempt a free ride, nobody gets a ride at all.

[67] For further discussion of the principle of community action to safeguard community resources, *see* J. Buchanan, The Demand and Supply of Public Goods (1968); The Governance of Common Property Resources (E. Haefele ed. 1974); Environmental Politics (S. Nagel ed. 1974); M. Olson, The Logic of Collective Action (1965).

[68] *See* Myers, *supra* note 1.

[69] *See id.* By comparison with conservation needs, the funds allocated to research on cheetah and other predators in Africa, are absurdly small. Whereas relatively substantial monies

proach lies in persuading the stockman to be more selective in his anti-predator response, by confining his attentions to those individual animals that are known to prey on domestic stock. Such random evidence as is available suggests that only a small number of cheetah regularly prey on calves and sheep.[70] More information is urgently needed on which sorts of domestic animals are taken. Do cheetah attack weak or sickly animals, *i.e.*, animals which will die shortly anyway? Since herds of wildebeest and zebra have been known to attack cheetah and drive them off in defense of their young,[71] perhaps a minimum size of domestic herd, with the security that numbers afford, would help to resist marauding cheetah.

Stockmen might also permit a fair number of wild herbivores to survive on their lands. An estimate from Kenya[72] suggests that if wildebeest, zebra, gazelle, and other species constitute 10 percent of herbivore biomass (total stocks measured by aggregate weight) on a ranch, they supply sufficient prey to all wild predators, whereupon stock losses remain more marginal.[73] Further possibilities lie in sophisticated techniques such as "aversive conditioning" of wild predators so that they avoid domestic stock, a method which has proved of some experimental value with coyotes in the United States.[74] A related possibility lies in chemical compounds which

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have been spent on intensive studies of individual populations of cheetah in Serengeti, Kruger and other parks, and disproportionately large sums on individual animals (the research findings of studies of pet cheetah have little application to other cheetah), virtually no funds have been devoted to analysis of conflicts between cheetah and domestic livestock in any part of Africa.

[70] *Id.*

[71] *Id.*

[72] FAO, Wildlife Management in Kenya: Interim Report, FO:DP/KEN/71/526, FAO, Rome (1975). A plan has been proposed by the World Bank to offer compensatory payments to Masai pastoralists in Kenya, to offset competitive grazing by wild herbivores in the hinterland zones of Nairobi and Amboseli Parks.

[73] The potential for measures of this sort is suggested from experience in Iran. Fifteen years of regulation of livestock numbers to permit a recovery of wild herbivores, in conjunction with stringent controls to eliminate illegal hunting, has led to a marked come-back for the cheetah so that current stocks have probably topped 200 (nothing better than low numbers is hoped for due to sparse prey in semi-desert environments) (F. Harrington, personal communication (1975)). Few details are available, however, of the costs of this program to the Iranian community in general and to particular livestock owners. Moreover, Iran possesses sufficient discretionary capital in the form of oil revenues to engage in conservation activities that other less-endowed countries might view as luxuries. When seven million head of livestock died in a 1970-72 drought, most of the stock raisers in question were able to give up their traditional existence and migrate to the fast-developing cities. This alternative is available to stockmen only in the three countries of Africa (Gabon, Libya and Nigeria) that possess oil—none of them with significant populations of cheetah.

[74] Gustavson, Garcia, Hankins & Rusiniak, *Coyote Predation Control by Aversive*

could be introduced into dipping fluid for livestock, leaving traces in a calf's or sheep's hide with a taste extremely repellent to carnivores.[75] Other methods have been proposed to tackle problems of wild predators and domestic stock in the United States, and some of them—for example, collars with spikes or bells, or other devices to deter predators—may be applicable in Africa.[76]

Any of these approaches would require large inputs of staff, time, funds, and related resources which African countries do not possess in large supply. This would present an opportunity for conservationists outside Africa to provide the required resources. That, however, is a remote prospect considering the limited contributions currently made available from outside Africa for wildlife conservation of all kinds. Ironically, $2.4 million have been allocated in the United States for the coyote problem, on which around 120 studies are in progress; yet the coyote, far from being a threatened creature like the cheetah, is increasing its present numbers of 2-2 1/2 million. A mere fraction of these control funds and research budgets could work wonders for the cheetah in Africa, where less than ten studies are underway, none of them directed at the species' relationships with the livestock industry.[77]

Perhaps the simplest and only satisfactory method to safeguard the cheetah is to dissuade stockmen from disposing of marauders. Almost certainly this implies some form of compensation.[78] Insofar

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Conditioning, 184 SCIENCE 581 (1974). The technique depends upon feeding coyotes with lamb carcasses laced with chemicals that cause violent vomiting for the coyotes; whereupon the coyotes become conditioned to take strong avoidance measures when they find themselves close to live lambs. Experimental trials under control conditions have proved encouraging, but few attempts have been made to apply the technique on a broad scale in the wild.

[75] *See* Myers, *supra* note 1.

[76] For an analysis of the predator problem in the United States, with implications for similar situations in Africa, see *Problems of Predator Control: Hearing Before Subcommittee on Public Lands, Senate Comm. on Interior and Insular Affairs*, Comm. Print (1972). Berryman, *The Principles of Predator Control*, 36 J. WILDLIFE MANAGEMENT 395 (1972); S. CAIN, PREDATOR CONTROL—1971 (1972); Hornocker, *Predator Ecology and Management—What Now?*, 36 J. WILDLIFE MANAGEMENT 401 (1972); F. Wagner, Coyotes and Sheep: Some Thoughts on Ecology, Economics and Ethics (44th Honour Lecture before the Faculty Association of Utah State Univ., Logan, Utah (1972)). For details on the coyote problem, and studies in the United States, see Terrill, *Livestock Losses to Predators*, in D. J. BOOKS, WESTERN WILDLANDS (1977).

[77] *Supra* note 69.

[78] This compensation idea is not new in principle. A similar procedure has been proposed, though not yet accepted, to protect coyotes in Utah. The plan envisions that the $1 million damages suffered by stockmen due to coyote ravages should be made good by a state-wide tax of $1 on each of the state's one million taxpayers (mostly urbanites, who favor the coyote) as a subsidy to the livestock industry (Predator Research Group, Utah State University,

as the cheetah "belongs" to Africa, part of the compensation burden should be assumed by African countries—which, however, already pay out significant sums to maintain wildlife.[79]

Indeed this stage of the problem is strongly marked by the socio-economic divergence between the advanced world, where most wildlife supporters live, and the developing world, where the threatened species phenomenon is growing acute. Developing countries are scarcely in a position to subsidize the rest of the world by safeguarding mankind's heritage of wildlife species. In addition to the socio-economic gap, a cultural dissonance between the developed and developing worlds persists: citizens of emergent countries do not yet perceive wildlife conservation with the urgency sometimes displayed by the affluent world. Thus, compensation for cheetah depredations would have to come mainly from affluent countries.

The question then arises of how much compensation would be entailed. Certain countries lend themselves to this calculation better than others. Namibia, for example, probably contains at least 2000 cheetah.[80] A principal Namibian export is Karakul lamb pelts, to be manufactured into coats for luxury markets in North America and Europe. Were complete protection for the cheetah to be declared and enforced in Namibia, the cost of producing Karakul pelts would go up. The increased costs would be reflected in fairly accurate form through international trade patterns:[81] enough pelts for a

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personal communication, 1976). Not only would this be equitable from the standpoint of the stock-owners, it would be efficient from the perspective of the community-at-large, since a tax is a sound way to avoid the free-rider problem (*see* note 66 *supra*). Regrettably, the Utah livestock industry has hitherto declined the proposal on the grounds that ranchers do not wish to be treated as welfare recipients.

[79] For example, Tanzania devotes a larger slice of these meager national funds to Serengeti, Ngorongoro and other wildlife spectacles than the United States spends by proportion on its wildlife. I-II, UNITED REPUBLIC OF TANZANIA, TANZANIA THIRD FIVE-YEAR PLAN FOR ECONOMIC AND SOCIAL DEVELOPMENT, 1975-79 (1975). Tanzania does this to safeguard what outsiders are not slow to remind Tanzanians is also the world's natural heritage.

[80] *See* Myers, *supra* note 1.

[81] For general treatment of international trade repercussions stemming from environmental protection, see d'Arge, Observations on the Economics of Transnational Environmental Externalities (paper presented at Conference on Economics of the Environment, sponsored by Universities-National Bureau Committee on Economic Research in conjunction with Resources for the Future (1972)); d'Arge & Kneese, *Environmental Quality and International Trade*, 26 INT'L ORG. 419 (1972); d'Arge & Kneese, *The Economics of State Responsibility and Liability for Environmental Degradation* (Working Paper No. 23, Program in Environmental Economics, Univ. of Cal., Riverside (1973)); Baumol, Environmental Protection, International Spillovers and Trade, (Wicksell Lectures, Stockholm Univ., 1971); Coan, Hillis & McCloskey, *Strategies for International Environmental Action*, 14 NAT. RESOURCES J. 87 (1974); Leontief, *Environmental Repercussions and the Economic Structure: An Input-*

coat might cost 10 percent or even 20 percent more. This would give a reasonable indication of costs entailed in protecting the cheetah in a single country. Cheetah supporters outside Africa could then consider whether to pay the difference between old and new costs, as compensation to Namibia's stockmen who raise Karakul lambs. Thus the cheetah's survival in Namibia would bear a clearer price tag, and conservationists could decide whether or not to pick it up. This is not to say that compensatory payments should be made by individual Americans and Europeans reaching into their pockets to send donations to Namibia. The proposal would need to be implemented through some sort of international fund, under the auspices of, perhaps, the United Nations Environmental Programme located in Nairobi.[82]

In similar fashion, it is possible to make a rough estimate of livestock losses in other countries with significant numbers of cheetah (Kenya, Tanzania, Zambia, and Botswana, as well as Namibia). Out of a total of 6000-9000 cheetah (preliminary estimates),[83] one cheetah in ten may well depend upon domestic stock for one kill in ten.[84] This results in a loss of domestic stock, mostly sheep and calves, of 4500-7000 hear per year. These domestic animals are worth approximately $200,000-300,000. This is an appreciable cost to meet each year, although not beyond the capacity of the community at large if it really wishes to protect the cheetah. It is a small sum compared with the hypothetical evaluation of the cheetah's worth estimated, as a minimum, at $20 million.[85]

The five African countries listed contain perhaps half of Africa's present stock of cheetah.[86] In other countries with smaller and more

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Output Approach, 52 REV. ECON. & STATISTICS 262 (1970); Majocchi, *The Impact of Environmental Measures on International Trade: Some Policy Issues, in* PROBLEMS OF ENVIRONMENTAL ECONOMICS 201 (1972); STUDIES IN INTERNATIONAL ENVIRONMENTAL ECONOMICS (I. Walter ed. 1976).

[82] *See* Subpart (b), "A Trust for Threatened Species," *infra*. The United Nations Environmental Programme (UNEP) is a recent initiative, set up as a consequence of the 1972 Stockholm Conference on the Human Environment. Unlike other U.N. agencies, it is not an executive agency, rather it is a coordinating body. It thus seems suitable for implementation of international cooperative ventures such as the "global subvention" proposed in this paper. UNEP is already responsible for various related initiatives, such as the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora, 3 ENVIR. L. REP. 1350 (1973).

[83] *See* Myers, *supra* note 1.

[84] *See also*, McLaughlin and N. WROGEMANN, *supra* note 5.

[85] *See* text at notes 59, 60, *supra*.

[86] *See* Myers, *supra* note 1.

dispersed numbers of cheetah, compensation to stockmen would be less likely to produce a comparable return. In these other fifteen to twenty countries, the situation should presumably be allowed to decline until the cheetah eventually disappears, unless the countries in question can devise alternative conservation strategies with an acceptable equilibrium between costs and benefits. As a consequence, society outside Africa would implicitly go along with the idea that these scattered cheetah populations in other countries are not worth the effort to save them. The outlays would be tacitly considered too large and the anticipated payoff too doubtful to make the investment worthwhile. For all intents and purposes, society would decide to finance protection in a limited number of countries, and turn its back on cheetah in other areas. Unfeeling as this decision might appear to some wildlife supporters, it would at any rate represent an advance on the present situation, where conservationists ostensibly assert they wish to save every cheetah alive, but, for lack of adequate means to express their commitment, implicitly comply with a steady decline in cheetah numbers on all sides.

In terms of practical implementation of the scheme in those countries that are deemed to merit compensatory payments, a number of questions would have to be answered. To meet the operational spirit of the idea, any stockman who suffers losses through cheetah depredations should receive some degree of compensation; stockmen who do not so suffer should not receive any funds. So presumably a claimant would have to demonstrate specific loss. At the same time, stock-raisers who receive compensation should not be allowed to go ahead and eliminate cheetah on their properties anyway. It is difficult to see how simple legal sanctions would be any more effective than existing provisions of law, due to enforcement problems in wide-reaching savannah zones—unless punitive measures were to be exceptionally severe.

Should a stockman receive complete compensation for all cheetah-caused losses? Or should he not accept some degree of responsibility for such losses, on the grounds that he should be ready to bear certain unprofitable consequences of raising stock in savannah areas? After all, he knows that in Africa's wildlands he may encounter drought, insect plagues, and other natural phenomena that deplete his grazing or otherwise undermine his way of earning a living, and he usually accepts these problems as part and parcel of trying to survive in partially hospitable, partially hostile environments. Should a stockman, in order to qualify for compensatory

funds, also be required to undertake, as a preliminary safeguard measure, some gesture that could help to keep cheetah away—for example, by maintaining a few large herds and flocks instead of many small ones (so that numbers offer some security against predators), or by using repellent dipping fluids? To undertake all such measures would be prohibitively expensive for almost all stock-raisers, but perhaps those who wish to qualify for the compensation program should be required to take some step on their own initiative. In addition, or alternatively, a stockman could be required to subscribe to a livestock-owners' insurance scheme against undue predator damages, probably subsidized by the government of the country in question before international compensation funds could be made available.

Various other theoretical and practical questions arise. This compensation proposal is suggested primarily as an instance of opportunities for society to ensure that cheetah protection does not inflict unduly regressive repercussions on livestock interests, with backlash response from stockmen who take the law into their own hands. The proposal is also presented as an illustration of the way society can express its preference through more effective action than the present approach with its dispersed efforts. An economic adjustment is necessary if the present position is to be remedied, since wildlife conservation in Africa hitherto amounts to a transfer of resources from Africa to the affluent world.[87]

A compensation scheme would need to be subject to periodic

[87] This approach is akin in spirit to the "additionality" concept advanced at the Stockholm Conference on the Human Environment. This concept implies compensation payments on appreciable scale from the developed world to the developing world to offset adverse repercussions on emergent economies arising from environmental safeguards. *See* Schneider-Sawiris, *The Concept of Compensation in the Field of Trade and Environment,* IUCN Environmental Policy and Law Paper No. 4, Morges, Switzerland (1974); McLeod, *Financing Environmental Measures in Developing Countries: The Principle of Additionality,* IUCN Environmental Policy and Law Paper No. 6, Morges, Switzerland (1974). As an instance of a high-income country extending a subsidy to a low-income country with the aim of modifying some production process with adverse environmental impact, the United States has extended appreciable monetary assistance to Mexico to enable it to eradicate hoof-and-mouth disease in cattle. Clawson, *Economic Development and Environmental Impact: International Aspects,* in POL. ECON. OF ENV'T 163 (Mouton, Paris/The Hague (1972)). In the case of the cheetah, of course, there would be more nations involved than just two, perhaps a dozen on either side. The need for a broad-scale flow of funds among the international community, to supplement marketplace and trade transactions, has been analyzed by Boulding & Pfaff, The Grants Economy and the Development Gap (paper presented at the Meeting of the Int'l Econ. Ass'n, Bled, Yugoslavia, Aug. 29, 1970), and by K. BOULDING, THE GRANTS ECONOMY IN INTERNATIONAL PERSPECTIVE (1974). *See also* J. GALBRAITH, ECONOMICS AND THE PUBLIC PURPOSE (1973).

reappraisal. If citizens in donor countries began to object to the financial strain, the scheme would have to be ended. Citizens of donor countries would thereby act in explicit recognition of what prospects face the cheetah, and would have a clear recognition of their responsibility in the situation. This would be in marked distinction from the present position, where people in developed nations have little chance to appraise their responsibility in clear-cut terms. Conversely, if after a few years public opinion seemed to favor an extension of the initiative, support could be made available for other countries with smaller numbers of cheetah, or the strategy could be extended to other threatened species whose plight lends itself to similar treatment. The entire project would serve as a measure of the public's readiness to pay for what it often suggests it wants.

With refinements through experience, this institutional device could even serve as a sort of proxy pricing system to express people's minimal appreciation of wildlife values in question. It could develop into a framework which reflects costs and benefits as perceived by the participant parties. The basic questions are how many cheetah should be protected, in which areas, for what periods of time, and at how much cost to whose pocket. A pay-for-what-you-want approach would permit a graded response to conservation alternatives.[88] The community at large could express its financial support for those species over those periods of time which it believes merit the gesture in comparison with other goods and services. This would relieve the "either/or" type of conflict situation where the issues are seen in inflexible terms.

(b) A Trust for Threatened Species

A dispensation of similar sort to the initiative proposed here will eventually be provided through the World Heritage Trust, established by the United Nations Educational, Scientific and Cultural Organization (UNESCO).[89] This institution will enable the interna-

[88] This approach is analogous in spirit to the regulation of pollution in North America and Europe through taxes and similar adjustable penalties rather than through imposition of absolutist standards. The regulatory procedure is adjustable since the penalty depends upon the polluter's readiness to abate the source of pollution. By contrast, a legal injunction against pollution allows the polluter no opportunity to relate the costs and benefits of abatement initiatives. *See* Haveman, *supra* note 62; ENVIRONMENTAL QUALITY ANALYSIS (A. Kneese & B. Bower eds. 1966); WATER RESEARCH (A. Kneese & S. Smith eds. 1966).

[89] *See* text of the WORLD HERITAGE TRUST, CONVENTION FOR THE PROTECTION OF THE WORLD CULTURAL AND NATURAL HERITAGE, UNESCO, Paris, France.

tional community to provide financial support to those countries unable to ensure protection on their own for unique items of mankind's natural and cultural heritage within their national territories. Present provision is for each member country of UNESCO to contribute an additional one percent of its customary subvention, plus such further funds as it wishes to demonstrate support of the Trust (no doubt in accord with its estimates of its citizenry's desires).[90]

In part the Trust will meet the needs of threatened species, since it will safeguard ecosystems which frequently offer sanctuary to species of localized distribution. But the cheetah illustrates the Trust's shortcomings for threatened species. Due to limited funds, and in order not to "dilute" the idea of the initiative, the Trust will assist only the most spectacular of Africa's parks and reserves, few of which contain many cheetah.

Furthermore, the Trust concept works best in once-and-for-all emergencies such as the Abu Simbel temples on the River Nile, whose protection by UNESCO in the mid-1960's triggered the notion of the World Heritage Trust.[91] The fund-raising campaign, conducted by UNESCO, raised $32 million, and saved the 5000 year-old temples. This effort represented a pioneering initiative by the world community to protect a significant part of the world's cultural heritage. The effort was concentrated, and all necessary funds were raised within a short time. However, a sustained campaign for funds would be more difficult to maintain. Also, the salvaged temples no longer demand large amounts of resources. By contrast, parks and reserves require that millions of acres of potentially productive land be withheld from use.

The World Heritage Trust is simple and direct in focus. By comparison, proposals for compensation payments to safeguard the cheetah might seem excessively impractical. Why should considerations of "return on investment" affect decisions to save wildlife species whose disappearance would represent irreversible loss? Conservation of the cheetah must take place, however, in the severely practical world of developing Africa, where land use activities are

[90] Until the United States suspended its contribution due to anti-Israel sentiment among many UNESCO member states, it was paying $143,000 per year.

[91] Ironically, the Abu Simbel temples were originally dedicated to crocodiles which now need broad-based protection measures similar to those required by the cheetah. Red Data Book, Int'l Union for the Conservation of Nature and Natural Resources (IUCN), Morges, Switzerland (1975). Cott & Pooley, The Status of Crocodiles in Africa, Supp. Paper No. 33, IUCN, Morges, Switzerland (1972).

almost always determined by marketplace evaluation. Stockmen presently appraise the "worth" of the cheetah through comparative assessment of trade-off transactions involved. They know what their calves are worth to them, and they care little about what the cheetah is worth to society, except that it does not compare in their eyes with the value of their stock. They unwittingly apply a form of cost-benefit analysis which results in a decision against the cheetah. Their appraisal parameters should somehow be expanded to accommodate the externalities of their actions—the loss to the world community. This postulates a system in which people outside Africa can express their preferences at the margin[92] as well as in total.

An initiative along these lines would constitute a worthwhile advance over outright regulation via "blunt-instrument"-type institutions such as the World Heritage Trust. After all, conservation of the cheetah, even in its present reduced numbers, is not worth a limitless commitment of financial and other resources. Indeed no species is beyond value, occasional conservationist assertions to the contrary; safeguarding the bald eagle is not worth the GNP of the United States, nor anything beyond a tiny fraction of it.

CONCLUSION

This analysis of the cheetah's niche in late 20th century Africa represents a new perspective for the threatened species problem. Protection of declining wildlife in Africa no longer depends on resisting the poacher or other individuals of direct and deliberate threat to vulnerable species. It depends on reconciling the legitimate activities of citizens in Africa with the interests of people in the developed world—who, if they want beef from African savannahs at "reasonable prices," should recognize the significance of their actions. A proposal for a fresh conservation strategy based on large-scale compensation may sound speculative at best, but it should be appraised in light of the options available. Present institutions offer no opportunity for society to express its preferences for goods without a price, or to establish property rights and responsibilities for the common heritage. Difficult as an expanded conservation strategy for the cheetah will be, the alternative is the present prospect, where decisions against the species are made with implicit indifference to the values at stake.

[92] The cheetah's value "at the margin" refers to the value of individual animals as part of the species' stock. The conservationist's evaluation should reflect whether he is concerned with the last 10,000 cheetah, or the last 1000, or the last breeding pair on earth.